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ABSTRACT

Investigators assessing the effect of activation on performance rarely report the effect of performance on motivation. College students (N=48), preselected by anxiety scores, were tested on adjective pairs lists; additionally, anxiety was measured before and after task performance. Results showed that anxiety had a marked effect on verbal learning performance. In a second study of 24 subjects, the anxiety variable did not significantly alter verbal learning performance. Subjects (N=60) preselected on the Spielberger trait anxiety test were tested on a high-speed tachistoscopic task and were given the Spielberger State Anxiety test following performance. Tachistoscopic recognition was not significantly altered by trait anxiety, but a significant correlation occurred between state anxiety and performance. Subjects (N=40) preselected on the Spielberger state anxiety scale were given the scale again immediately preceeding the tachistoscopic task to reveal the effect of anxiety on performance. Results showed that anxiety had no significant effect on tachistoscopic recognition. While only one investigation obtained clear evidence that pre-performance anxiety significantly altered performance, subjects' anxiety was altered significantly as a function of task performance in all four investigations. The findings suggest that anxiety may not remain at a constant level for the duration of an experiment. (NRE)

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ANXIETY AND PERFORMANCE:
Each Affects the Other One

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Paper presented at the Annual Convention of the American Psychological Association, Los Angeles, CA, August 25, 1981.

Anxiety and Performance: Each Affects the Other One

Paper presented August 25, 1981, American Psychological Association, Los Angeles.

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The present paper presents findings from four studies conducted by the investigator that reveal the reciprocal relationship between anxiety and performance on tasks involving verbal learning and memory. Studies on the effect of anxiety on learning and performance in laboratory tasks were conducted in large number in the 1950's and 1960's, in part due to the seminal influence of Spence and Taylor (Spence, Taylor, & Ketchel, 1956). Fairly consistent success was found in demonstrating that anxiety facilitates eyeblink conditioning, but, overall, studies were not successful in establishing the effects of anxiety on verbal learning. The results indicated all possible outcomes: anxiety sometimes improved and sometimes impaired verbal learning performance, and sometimes it had no significant effect. Efforts to replicate the results of Spence and his colleagues were not consistently successful, even when response competition was clearly manipulated and even when lists used by Spence were also used by other researchers (Thayer & Cox, 1968).

Explanations for the inconclusive findings were many. Some attributed the cause to Hullian theory (Weiner & Schneider, 1971) and some to the Taylor scale as not adequately measuring anxiety (Mandler & Sarason, 1952). Some focused on the problem in terms of the response definition of anxiety (Ferguson, 1974), since most of the studies reported in the literature manipulated the independent variable on the basis of subjects' scores on an anxiety scale. Others who were not concerned with anxiety but rather with the effect of arousal on paired-associate learning raised the point that effects of arousal may not be found for paired-associate learning because aspects of learning, such as order information, may be altered by arousal while aspects such as involved in the

usual paired-associate paradigm may not be altered (Hamilton, Hockey, & Quinn, 1972).

The present investigation addresses a different issue than the above, although the above appear to be at least partly valid explanations for some of the failures reported in the literature concerning the effect of anxiety on performance in verbal learning experiments. The question raised in the present investigation concerns the assumption generally held in research assessing the effects of anxiety, namely, that anxiety remains at a fixed level for the duration of an experiment. To answer the question, four studies were conducted in which anxiety was measured both before and following task performance.

Method and Results

The first two studies pre-selected subjects (college students) on the basis of their Alpert-Haber (1960) anxiety scores. The first study used 48 subjects and the second used 24 subjects. All subjects were tested individually, on two lists containing adjective pairs used by Thayer and Cox (1968) and before that by Spence, Farber and McFann (1956). Additional adjectives were taken from the original pool from which Spence et al (1956) first derived their lists, thus giving two comparable lists of ten adjective-pairs with high intrapair association and low intralist association. On this type of list subjects with high motivation (anxiety) should show better performance than those with low motivation according to Hullian drive theory. High and low ego-involvement instructions were given to all subjects,so that half learned the first list under high ego-involvement and the other half under low ego-involvement, with conditions reversed for the second list. Ego-involvement instructions were comparable to those described already (Ferguson, 1974). The Thayer activation scale (Thayer, 1967) was given four times: once before the start of the learning task but immediately following the ego-involving instructions; once immediately following the learning task, and this was done for the two learning lists.

In Study 1 four anxiety groups each consisted of 12 subjects. List learning was to a criterion of two consecutive perfect trials. In Study 2 only two groups were tested (those high in debilitating and low in facilitating anxiety, versus subjects who were low in both debilitating and facilitating anxiety). Criterion was

learning to one perfect trial. Analysis of the results for these two studies indicated that the two lists were of comparable difficulty level. Study 1 analyses were based on 4 x 2 x 2 ANOVAs involving Anxiety x Ego-Involvement x Order of Instructions (high or low ego-involvement). As can be seen from Table 1, anxiety, and not ego-involvement, had a marked effect on verbal learning performance. For trials to criterion in Study 1, F was 3.25 ($p<.03$) and for mean number of errors F was 2.63 ($p<.06$). Not shown in Table 1 but crucial to the purpose of the study, the High Activation scores, which are identified as measuring primarily anxiety (Thayer, 1978), were significantly different for the two ego-involvement conditions after the completion of the learning trials but not prior to the learning task. The high ego-involvement condition yielded higher High Activation scores than did the low ego-involvement condition following the learning trials ($F = 11.56$, $p<.002$), while no significant difference was found prior to the learning trials. In Study 2 neither the anxiety nor the ego-involvement variable significantly altered verbal learning performance. However, as in Study 1, the high ego-involvement instructions resulted in significantly higher High Activation scores after but not before the learning trials, compared to the low ego-involvement instructions ($F = 7.39$, $p<.02$).

Table 1

Verbal Learning Performance: Study 1

	Mean Trials to Criterion		Mean Number of Errors	
	High Ego-Inv.	Low Ego-Inv.	High Ego-Inv.	Low Ego-Inv.
Anxiety Condition				
High Debilitating-High Facilitating	4.75	5.00	9.03	7.50
High Facilitating-Low Debilitating	6.17	6.50	11.58	10.33
High Debilitating-Low Facilitating	6.92	5.83	13.02	9.42
Low Facilitating-Low Debilitating	8.58	7.67	21.13	14.83

In Study 3 sixty subjects and in Study 4 forty subjects were tested, individually, on a high-speed tachistoscopic task. Words were presented repeatedly for a brief (10 msec) duration until correct recognition. Using this procedure, an earlier study (Erwin & Ferguson, 1979) had found hunger and thirst motivation to have a significant effect on word recognition, and Studies 3 and 4 sought to identify if anxiety had an effect comparable to that found for hunger and thirst. In Study 3 subjects were pre-selected on the Spielberger trait anxiety test (Spielberger, Gorsuch, & Lushene, 1970), with half the subjects being high and half low in trait anxiety. Following their performance on the tachistoscopic task, all subjects were given the Spielberger state anxiety test. Tachistoscopic recognition was found not to be significantly altered by trait anxiety but a significant correlation was obtained between state anxiety and performance on the tachistoscopic task ($r = +.40$, $p = .002$). The correlation indicated that subjects with high state anxiety also required more word presentations before being able to recognize the words. Because the results had far-reaching implications, suggesting that anxious subjects process information in a defensive manner, it was tempting to ignore the dictum that correlation does not signify causation. However, the data obviously could be interpreted in two ways: that state anxiety impaired high-speed information processing, or, alternatively, that performance altered anxiety, with successful performance leading to low anxiety and poor performance leading to high anxiety. To test this assumption, subjects in Study 4 were pre-selected on the Spielberger state anxiety scale and then given that same scale again, immediately preceding the tachistoscopic task. If anxiety altered performance, this procedure would reveal that fact. Additionally, all subjects received the Thayer activation test immediately following the tachistoscopic task.

The results for Study 4 showed clearly that anxiety had no significant effect on tachistoscopic recognition. The correlation between scores on the first state anxiety test and performance on the tachistoscopic task was +.002, and between

scores on the second state anxiety test (taken immediately preceding the tachistoscopic task) and tachistoscopic performance was +.054. The hypothesis that in Study 3 the significant correlation between anxiety and task performance was caused by the performance altering anxiety was largely confirmed by the Thayer scores in Study 4. These scores were obtained immediately following task performance and scores on the General Activation and the Deactivation Sleep scales correlated with tachistoscopic task performance, respectively, with $r = -.27$, $p < .10$ and $r = +.28$, $p < .08$. The correlations with these Factor A Thayer scales (Thayer, 1978) show that subjects who had high performance on the tachistoscopic task (recognized the words sooner) also were more alert following the task than subjects who performed poorly on the task. The High Activation scale on the Thayer test gave similar but less dramatic results.

Conclusion and Implications

In four studies the state of motivation of subjects was altered significantly as a result of subjects' participation in learning tasks. Only one study obtained clear-cut evidence that anxiety prior to the learning task altered verbal learning performance. Researchers assessing the effects of anxiety on learning and word processing need to re-consider the basic assumption generally held, that anxiety level remains constant throughout the duration of an experiment. Alternative research strategies, involving tighter control over the independent variable, are strongly recommended. Utilizing stimulus-defined rather than response-defined motivation variables is one alternative, and measuring subjects' motivation prior to as well as following task performance, provides more certain information regarding the reciprocal relationship between performance and motivation in general, and performance and anxiety, specifically.

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Table 1

Verbal Learning Performance: Study 1

Anxiety Condition	Mean Trials to Criterion		Mean Number of Errors	
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Low Facilitating-Low Debilitating	8.58	7.67	21.13	14.83

For Anxiety, F=3.25, p = .03 for Trials to Criterion, F=2.63, p = .06 for Errors. Effect of Ego-Involvement was not significant for either measure.

Table 2

Verbal Learning Performance: Study 2

Anxiety Condition	Mean Trials to Criterion		Mean Number of Errors	
	High Ego-Inv.	Low Ego-Inv.	High Ego-Inv.	Low Ego-Inv.
High Debilitating-Low Facilitating	4.92	4.25	12.67	10.58
Low Facilitating-Low Debilitating	3.42	3.25	8.30	7.48

Neither Anxiety nor Ego-Involvement had a significant effect.

Table 3

Mean Number of Trials to Tachistoscopic Recognition: Study 3

	Generated Value of Stimulus Words		
Anxiety Condition	High	Medium	Low
High Trait	8.76	10.53	13.09
Low Trait	8.03	10.26	11.72

Effect of Anxiety was not significant, but Generated Value was ($F=24.73$, $p<.001$). State Percentile scores correlated significantly with recognition, $r=+.40$, $p<.002$). Trait Percentile scores correlated with recognition with $r=+.04$, n.s.